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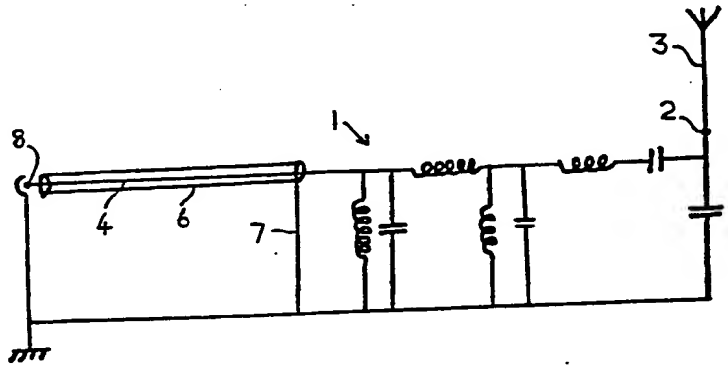
(54) Impedance matching circuit for an aerial

(57) In an impedance matching circuit for an aerial which may be used for transmission or reception purposes, which circuit includes a network (1) of inductors and capacitors via which the aerial (3) is fed, the matching circuit includes a predetermined length of a coaxial line (4, 6) by which signals for transmission are fed to the network or signals are fed from the network to a receiver. The length of the coaxial transmission line (4, 6) is selected to control signal phase shift and give a variable impedance over a wide frequency band.

This circuit allowed losses in the signal strength to be reduced so that the effective range of the aerial could be increased.



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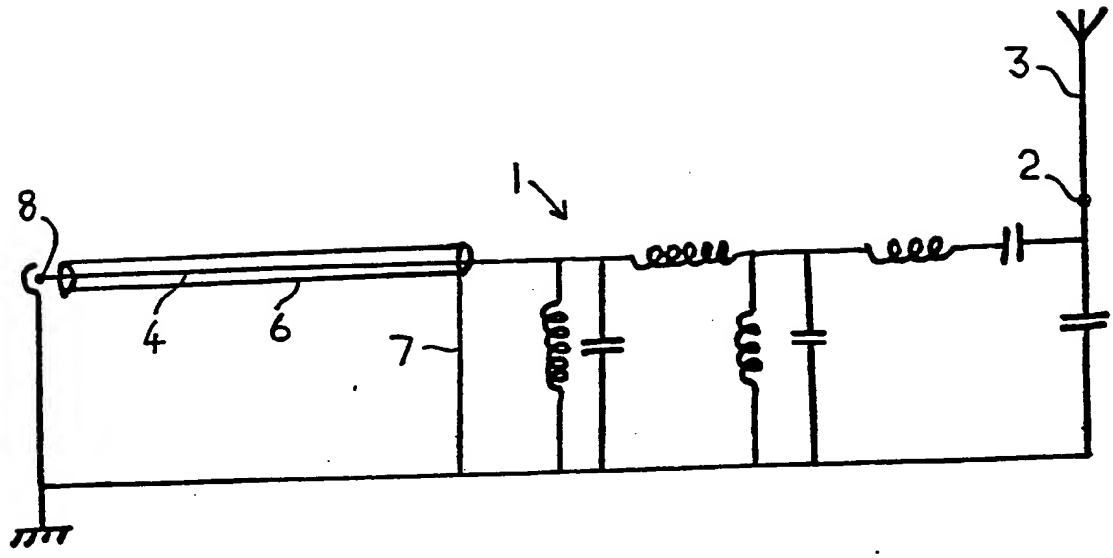

SPECIFICATION

Impedance matching circuit

This invention relates to an impedance matching circuit. It relates particularly to a circuit which is capable of being used with an aerial for transmission or reception purposes and which is able to effect the aerial matching requirements with a minimum of attenuation such that the efficiency of the aerial system can be increased.

In the construction of an aerial system for a radio transmitter/receiver one aerial design that might be used is that of a wideband end fed whip antenna. The aerial matching circuit usually consists of a transmission line having a characteristic impedance, loss and length which is selected to minimise the loss requirement. This transmission line provides an impedance match between a simple matching circuit loaded with the end fed antenna and the radio transmitter/receiver. However, the use of such a fixed attenuator can bring a disadvantage in that the load presented by the antenna varies rapidly with frequency and the loss which is introduced, and which is dependent on the load impedance presented to it, can become very large.

The matching circuit of the invention was devised to provide an alternative attenuator construction which is frequency and phase dependent and which can enable the radiating efficiency of the antenna system to be increased.

According to the invention, there is provided an impedance matching circuit for an aerial which may be used for transmission or reception purposes, which circuit includes a network of inductors and capacitors via which the aerial is fed, the matching circuit further including a predetermined length of a coaxial line by which signals for transmission are fed to the network or signals are fed from the network to a receiver, the length being chosen so as to afford a predetermined phase shift in the signal effective to minimise signal losses in the circuit.

Preferably, the coaxial line is a lossy transmission line with a length chosen to provide the minimum attenuation and optimum phase correction between a radio communication apparatus and the network of inductors and capacitors.

The impedance matching circuit may be constructed as part of a radio communication apparatus. An aerial associated with the apparatus may be of an end fed whip antenna construction.

By way of example, a particular embodiment of the invention will now be described with reference to the accompanying drawing, the single figure of which shows a circuit diagram of the impedance matching circuit.

As shown in the Figure, the impedance matching circuit comprises an inductor/capacitor network 1 having an output terminal 2 to which an aerial 3 is connected. At a left hand end of the network 1, the network is connected to an inner conductor 4 of a length of coaxial transmission line. An outer sheath 6 of the line is joined to earth by means of the lead 7.

The left hand end of the inner conductor 4 is secured to an input terminal 8 for the impedance matching circuit.

In operation of the impedance matching circuit, the input terminal 8 is connected to an output terminal of a radio transmitter (not shown). The output terminal 2 of the matching circuit is connected to the aerial 3 which in this example is an end fed whip antenna.

In a conventional impedance matching circuit which makes use of a fixed attenuator having a nominated input and output impedance, the load presented to the circuit by the antenna varies rapidly with frequency. Consequently, the signal loss which is introduced by the fixed attenuator, being dependent on the load impedance presented to it, becomes very large.

In contrast to this, in the matching circuit of the invention, the attenuator which is embodied in the length of transmission line (4, 6) is both frequency and phase dependent such that the degree of attenuation depends on the requirements demanded by the antenna impedance in relation to the requirements of the impedance of the matching circuit. Thus the impedance matching requirements over a wide frequency range are achieved with only a minimum level of attenuation. This gives an increase in the radiating efficiency of the antenna system.

The length of the transmission line (4, 6), and thus the phase shift and signal loss level of the transmission line, is chosen so as to minimise the variable impedance whilst keeping the loss as low as possible. By this means, it is found possible to reduce the standing wave ratio as seen by the transmitter to less than 3.5:1 using a reference of 50 ohms with a 1.4 metre length of whip antenna, and to less than 5:1 using a 1/2 metre length of whip antenna.

It will be clear that whilst this embodiment has been described particularly as an impedance matching circuit for use with a ratio transmitter, the construction applies equally to use of the matching circuit with a radio receiver. The use of the matching circuit enables the radiating efficiency of the antenna system to be increased so that an increased transmission or reception range can be achieved.

The foregoing description of an embodiment of the invention has been given by way of example only and a number of modifications may be made without departing from the scope of the invention as defined in the appended claims. For instance, where it is required to couple together different units of a radio frequency communication system and there is a limitation on the level of signal attenuation that is permitted, the impedance matching circuit of the invention could be used with advantage.

CLAIMS

1. An impedance matching circuit for an aerial which may be used for transmission or reception purposes, which circuit includes a network of inductors and capacitors via which the aerial is fed, the matching circuit further including a predetermined length of a coaxial line by which signals for transmission are fed to the network or signals are fed from the network to a receiver, the

length being chosen so as to afford a predetermined phase shift in the signal effective to minimise signal losses in the circuit.

2. A matching circuit as claimed in Claim 1, in which the said coaxial line is a lossy transmission line with a length chosen to provide the minimum attenuation and optimum phase correction for signals passing between a radio communication apparatus and the said network of inductors and capacitors.

3. Radio communication apparatus including an impedance matching circuit as claimed in Claim 1 or 2.

4. Radio communication apparatus as claimed in Claim 3, including an end fed whip antenna aerial construction.

5. An impedance matching circuit substantially as hereinbefore described with reference to the accompanying drawing.

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